

STRUCTURAL AND OPTICAL PROPERTIES OF ZnS

P.ANTONY LYLA¹, K.SEEVAKAN²

¹Assistant Professor, Dept. of Physics, ²Department of Bioinformatics,

¹BIST, BIHER, Bharath university, Chennai-73,

antonylyla.phy@bharathuniv.ac.in

ABSTRACT:

ZnS is a rarely investigated compound as well as a commercially important semiconductor. It is less toxic, efficient, cost effective material and hence this compound has been chosen for investigation. ZnS nanoparticles are prepared by co precipitation technique using PEG 8000 as capping and stabilizing agent, which modify surface of nanoparticles and prevents the growth of the particles to larger size. There are several methods available to synthesis ZnS nanoparticles. Out of many methods that are available to synthesis nano ZnS, simple chemical precipitation method was chosen as it is one of the simplest method that can be easily carried out in a laboratory with simple equipment. It is cost effective and scaling up is possible. The characteristic of the synthesised nanoparticles were investigated and studied using the basic analysis test called as X-ray Diffraction Analysis. The detailed studies and explanation has been discussed below.

METHODS AND PREPARATION:

SYNTHESIS PROCEDURE:

The synthesis work was done at Materials Science and Instrumentation Lab, Department Of Physics[1-9], Madras Christian College. All the glasswares were cleaned using distilled water and was dried in an hot air oven for 15min at 90°C before the sample preparation. ZnS nanoparticles were synthesized using PEG 8000 as capping agent by simple co-precipitation technique. The principle involved in this technique is the precipitation of metal ions with sulphide ions in the solution. 1 M aqueous solution of zinc acetate and 1 M aqueous solution of sodium sulphide were mixed in the presence of the capping agent PEG 8000. First, solutions of 1 M zinc acetate[10-16], 1 M of sodium sulphide and 1% by weight of capping agents were prepared in double distilled water. 50ml of zinc acetate and 50ml of 1% of PEG were mixed together and stirred for 30 minutes on a magnetic stirrer to get a homogenous solution[17-23]. This was followed by drop wise addition of 50 ml of 1 M sodium sulphide under vigorous stirring for 1 hour. The reaction mixture was left undisturbed

for 20 hours. After this[24-29], the supernatant liquid was removed and the precipitate was collected. The product was rinsed twice with distilled water and once with acetone. The product was dried in hot air oven at 90° C for 3 hours and then at 110°C for 5 hours[30-45]. After drying, the product was made into a fine powder by milling it in the mortar and pestle for 10 minutes[46-50].



Fig 3.4 Zns Nano powder obtained

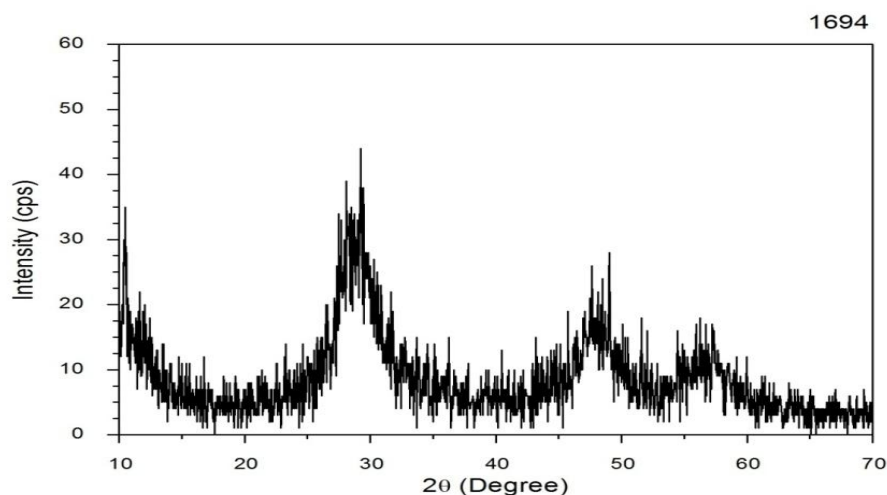
RESULTS AND DISCUSSION:

X-RAY DIFFRACTION ANALYSIS:

The XRD was taken at Nuclear Physics Department, Univesity of Madras using Guiner Powder Diffractometer (SAIFERT BYZ 202 MODEL), the intensity versus 2θ graph was recorded using $\text{CuK}\alpha$ ($1.54\text{\AA}$) as the source. The intensity for 2θ values in the range 20 to 80 are obtained. The XRD result of the synthesised ZnS nano particles by the above explained route is shown below in the fig 3.5. The ZnS pattern has been compared with the standard JCPDS 05-0566 pattern and observed that the peak position of the ZnS agrees well with the standard JCPDS pattern and no characteristic peaks of impurities were found. The phase structure of ZnS was found to be cubic. It confirmed that the peaks are due to diffraction from planes (111), (220) and (311). The average crystallite size (d) can be calculated using the scherrer's formula,

$$d = 0.9 \lambda / \beta \cos \theta$$

β is the broadening of diffraction line measured at full width of half maximum intensity (rad)
 $\lambda = 1.5406 \text{ \AA}$ is the wavelength of CuK α radiation[48]. The average crystallite size calculated for the ZnS sample was found to be in the range 4nm to 26nm.



SEM ANALYSIS:

The SEM analysis of the ZnS nanoparticles was investigated at SAIF Department, IIT Madras using HITACHI model. The shape and morphology of the synthesised ZnS nanoparticles were studied from SEM analysis. Fig 3.6 & 3.7 displays the surface morphology of the sample. The size of the nanoparticles was found to be around 33 nm to 38nm, shown in fig. The particles are seen agglomerated flaky nature is seen in the morphology. Agglomeration may be due to the thermal treatment given to the sample.

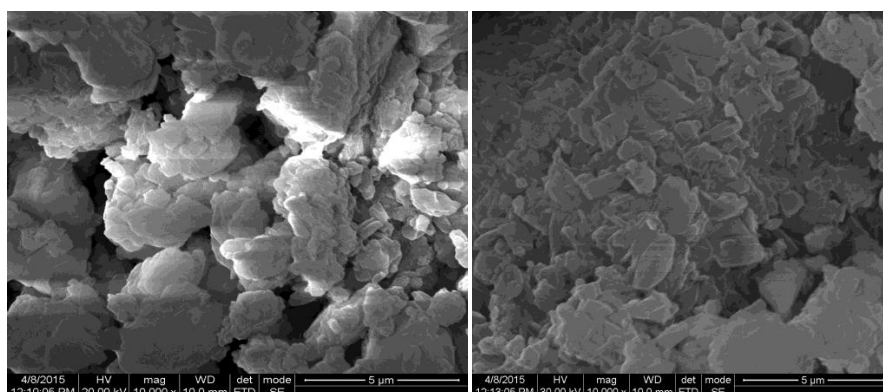


Fig 3.6 (A)

Fig 3.6 (B)

Fig 3.6 (A & B): SEM image with scale bar length of 5 μ m

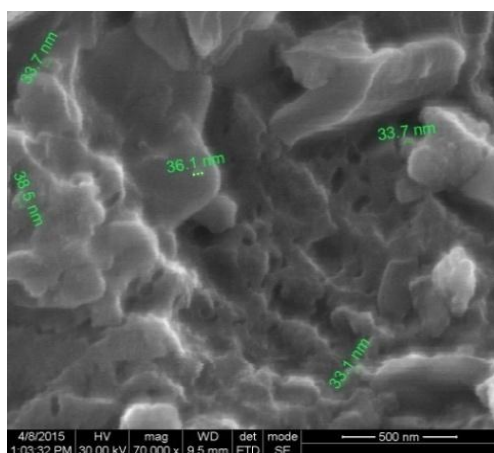


Fig 3.7 :SEM image with scale bar length of 500nm

CONCLUSION:

ZnS is a rarely investigated compound as well as a commercially important semiconductor. It is less toxic, efficient, cost effective material and hence this compound has been chosen for this project work. It is cost effective, economic and technically viable method. The parent material used for the synthesis of ZnS nano powder were Zinc Acetate and Sodium Sulphide. The product obtained were characterised by XRD and SEM.

XRD confirms the product formed is ZnS. No additional peak of impurities were found. This confirms the high purity of the sample. The phase structure was found to be cubic. The size of nano particles using scherrer's formula was found to be in the range 4nm to 26nm. The morphology of the sample indicated flaky nature and were seen agglomerated. The particle size calculated from the SEM image were in the range 33nm to 38nm.

REFERENCE:

1. Ramamoorthy, R., Kanagasabai, V., Kausalya, R., Impact of celebrities' image on brand, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-251-253, 2017
2. Ramamoorthy, R., Kanagasabai, V., Vignesh, M., Quality assurance in operation theatre with reference to fortis malar hospital, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-87-93, 2017
3. Ramya, N., Arthy, J., Honey comb graphs and its energy, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-83-86, 2017

4. Ramya, N., Jagadeeswari, P., Proper coloring of regular graphs, International Journal of Pure and Applied Mathematics, V-116, I-16 Special Issue, PP-531-533, 2017
5. Ramya, N., Karunagaran, K., Proper, star and acyclic coloring of some graphs, International Journal of Pure and Applied Mathematics, V-116, I-16 Special Issue, PP-43-44, 2017
6. Ramya, N., Muthukumar, M., On coloring of 4-regular graphs, International Journal of Pure and Applied Mathematics, V-116, I-16 Special Issue, PP-491-494, 2017
7. Ramya, N., Muthukumar, M., On star and acyclic coloring of graphs, International Journal of Pure and Applied Mathematics, V-116, I-16 Special Issue, PP-467-469, 2017
8. Ramya, N., Pavi, J., Coloring of book and gear graphs, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP-401-402, 2017
9. Ramya, P., Hameed Hussain, J., Alteration framework for integrating quality of service in internet real-time network, International Journal of Pure and Applied Mathematics, V-116, I-8 Special Issue, PP-57-61, 2017
10. Ramya, P., Sriram, M., Tweet sarcasm: Peep, International Journal of Pure and Applied Mathematics, V-116, I-10 Special Issue, PP-231-235, 2017
11. Sabarish, R., Meenakshi, C.M., Comparision of beryllium and CI connecting rod using ansys, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP-127-132, 2017
12. Sabarish, R., Rakesh, N.L., Outcome of inserts for enhancing the heat exchangers, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP-419-422, 2017
13. Sangeetha, M., Gokul, N., Aruls, S., Estimator for control logic in high level synthesis, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-425-428, 2017
14. Sangeetha, M., Gokul, N., Aruls, S., Image steganography using a curvelet transformation, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-417-422, 2017
15. Saraswathi, P., Srinivasan, V., Peter, M., Research on financial supply chain from view of stability, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP-211-213, 2017
16. Saravana Kumar, A., Hameed Hussain, J., Expanding the pass percentage in semester examination, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP-45-48, 2017
17. Saravana, S., Arulselvi, S., AdaBoost SVM based brain tumour image segmentation and classification, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-399-403, 2017
18. Saravana, S., Arulselvi, S., Dynamic power management monitoring and controlling system using wireless sensor network, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-405-408, 2017
19. Saravana, S., Arulselvi, S., Clustered morphic algorithm based medical image analysis, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-411-415, 2017

20. Saravana, S., Arulselvi, S., Networks, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-393-396, 2017
21. Saritha, B., Chockalingam, M.P., Adsorptive removal of heavy metal chromium from aqueous medium using modified natural adsorbent, International Journal of Civil Engineering and Technology, V-8, I-8, PP-1382-1387, 2017
22. Saritha, B., Chockalingam, M.P., Adsorptive removal of brilliant green dye by modified coconut shell adsorbent, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-211-215, 2017
23. Saritha, B., Chockalingam, M.P., Photodegradation of eriochrome black-T dye from aqueous medium by photocatalysis, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-183-187, 2017
24. Saritha, B., Chockalingam, M.P., Photodradation of malachite green DYE using TiO_2 /activated carbon composite, International Journal of Civil Engineering and Technology, V-8, I-8, PP-156-163, 2017
25. Saritha, B., Chockalingam, M.P., Synthesis of photocatalytic composite Fe-C/TiO₂ for degradation of malachite green dye from aqueous medium, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-177-181, 2017
26. Saritha, B., Chockalingam, M.P., Removal of heavy $\text{X}^{\text{X}}\text{l}$ from aqueous medium using modified natural adsorbent, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-205-210, 2017
27. Saritha, B., Chockalingam, M.P., Degradation of malachite green dye using a semiconductor composite, International Journal of Pure and Applied Mathematics, V-116, I-13 Special Issue, PP-195-199, 2017
28. Sartiha, B., Chockalingam, M.P., Photocatalytic decolourisationof textileindustry wastewaterby TiO₂, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-221-224, 2017
29. Sartiha, B., Chockalingam, M.P., Study on photocatalytic degradation of Crystal Violet dye using a semiconductor, International Journal of Pure and Applied Mathematics, V-116, I-18 Special Issue, PP-209-212, 2017
30. Shanthi, E., Nalini, C., Rama, A., The effect of highly-available epistemologies on hardware and architecture, International Journal of Pharmacy and Technology, V-8, I-3, PP-17082-17086, 2016
31. Shanthi, E., Nalini, C., Rama, A., Drith: Autonomous,random communication, International Journal of Pharmacy and Technology, V-8, I-3, PP-17002-17006, 2016
32. Shanthi, E., Nalini, C., Rama, A., A case for replication, International Journal of Pharmacy and Technology, V-8, I-3, PP-17234-17238, 2016
33. Shanthi, E., Nalini, C., Rama, A., Elve: A methodology for the emulation of robots, International Journal of Pharmacy and Technology, V-8, I-3, PP-17182-17187, 2016
34. Shanthi, E., Nalini, C., Rama, A., Autonomous epistemologies for 802.11 mesh networks, International Journal of Pharmacy and Technology, V-8, I-3, PP-17087-17093, 2016
35. Sharavanan, R., Golden Renjith, R.J., Design and analysis of fuel flow in bend pipes, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP-59-64, 2017

36. Sharavanan, R., Jose Ananth Vino, V., Emission analysis of C.I engine run by diesel,sunflower oil,2 ethyl hexyl nitrate blends, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-403-408, 2017
37. Sharavanan, R., Sabarish, R., Design of built-in hydraulic jack for light motor vehicles, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP-457-460, 2017
38. Sharavanan, R., Sabarish, R., Design and fabrication of aqua silencer using charcoal and lime stone, International Journal of Pure and Applied Mathematics, V-116, I-14 Special Issue, PP-513-516, 2017
39. Sharmila, G., Thooyamani, K.P., Kausalya, R., A schoolwork on customer relationship management with special reference to domain 2 host, International Journal of Pure and Applied Mathematics, V-116, I-20 Special Issue, PP-199-203, 2017
40. Sharmila, S., Jeyanthi Rebecca, L., Anbuselvi, S., Kowsalya, E., Kripanand, N.R., Tanty, D.S., Choudhary, P., Swathy Priya, L., GC-MS analysis of biofuel extracted from marine algae, Der Pharmacia Lettre, V-8, I-3, PP-204-214, 2016
41. Sidharth Raj, R.S., Sangeetha, M., Data embedding method using adaptive pixel pair matching method, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP-417-421, 2017
42. Sidharth Raj, R.S., Sangeetha, M., Android based industrial fault monitoring, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP-423-427, 2017
43. Sidharth Raj, R.S., Sangeetha, M., Mobile robot system control through an brain computer interface, International Journal of Pure and Applied Mathematics, V-116, I-15 Special Issue, PP-413-415, 2017
44. Sivaraman, K., Sundarraaj, B., Decisive lesion detection in digital fundus image, International Journal of Pure and Applied Mathematics, V-116, I-10 Special Issue, PP-161-164, 2017
45. Sridhar, J., Sriram, M., Cloud privacy preserving for dynamic groups, International Journal of Pure and Applied Mathematics, V-116, I-8 Special Issue, PP-117-120, 2017

